

PRE-OVERLAY REPAIR OF EXISTING CONCRETE AND ASPHALTIC PAVEMENTS

PHASE II

RESEARCH WORK PLAN

By

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1. SCOPE OF WORK

Task 1. FWD Tests

The research team will conduct falling weight deflectometer (FWD). FWD tests will be used to predict the field performance of new overlays. The research team is expected to work on 15 field projects: 9 overlay projects on existing asphalt pavements and 6 overlay projects on existing concrete pavements. The 9 overlay projects on existing asphalt pavements will consist of 6 overlay projects with milling as pre-overlay repair (4 milling and overlay projects and 2 milling w/re-lay and overlay projects) and 3 overlay projects with milling and asphalt patching. The 6 overlay projects on existing concrete pavements will consist of 4 overlay projects with doweled concrete patching, and 2 overlay projects with non-doweled concrete patching and/or asphalt patching. In case of no non-doweled concrete patching and/or asphalt patching projects are found, all 6 concrete projects will be overlays with doweled concrete patching.

Task 2. Data Analysis

Subtask 2.(a): Determine Overlay Lives with Different Pre-Overlay Repair Methods/Amount.

The pre-overlay repair methods and amount greatly affect the performance and lives of asphalt overlay. To evaluate the cost-effectiveness of pre-overlay repair method/amount, a life cycle cost analysis of these repair methods and amount has to be performed to identify the most cost-effective practices. However, to perform a life cycle cost analysis, the lives of asphalt overlays with different pre-overlay repair methods/amount have to be determined. The service life of second overlay on existing pavement will be determined separately from first overlay, because the second overlay often has shorter life. This is especially true for second overlay on existing concrete pavement. In addition, the service life of asphalt overlay may vary, depending on the function classes of highways.

The team will perform survival analysis to estimate the service lives for asphalt overlay on both asphalt and concrete pavement, with different pre-overlay repair methods and function classes of highways, respectively. The pavements to be used in survival analysis will include those in service and those that have failed. These pavement analyses will be based on the data collected from as-built plans and PIF of project since 1989. The failure of a pavement is defined as a pavement has received significant rehabilitation/reconstruction or the performance has reached threshold.

Subtask 2.(b): Perform Life Cycle Analysis and Compare Cost-effectiveness of Pre-overlay Repair Methods.

Once the lives of asphalt overlay with different repair methods/amount are obtained, life cycle cost analysis of these repair methods/amount will be conducted. The team will use FHWA LCCA Spreadsheet which is a very comprehensive LCCA method. The FHWA LCCA includes agency costs, user costs, and service life. The inputs for LCCA will be significantly different between the function classes of highways. Therefore, to closely compare the cost-effectiveness of pre-overlay repair methods/amount, the highways will be categorized based on their function classes. LCCA will be performed for each of the function classes.

Task 3. Validation of Previous Findings for Guideline Development

Subtask 3.(a) Statistical Analysis of Previous Overlay Performance

With more data available, statistical analysis will be performed to validate previous findings in project 0092-04-05.

For asphalt pavement, the dependent variables will be performance of overlay, either the PDI development rate or the individual distress development rates. The independent variables include continuous and categorical variables, as follows:

Continuous variables: overlay thickness, milling or pulverization depth, pre-overlay PDI or pre-overlay individual distress indicators, traffic, existing base and asphalt layer thickness, and soil support value.

Categorical variable: Repair methods (milling, pulverization, and patching).

For overlay on existing concrete pavement, the dependent variables will be the overlay performance, either the PDI development rate or the individual distress development rate. The independent variables include continuous and categorical variables, as follows:

Continuous variables: overlay thickness, repair amount, pre-overlay PDI or pre-overlay individual distress indicators, traffic, existing base and asphalt layer thickness, and soil support value.

Categorical variable: Repair methods.

Analysis of covariance (ANCOVA) will be used for statistical analysis, if the data is balanced. Otherwise, the general linear model has to be used if the data is unbalanced. Along with the LCCA results, the findings will provide the basis for guideline development.

Subtask 3.(b) Data Analysis of Effects of Pre-overlay Repair on Overlay Performance

The research team will analyze the data collected from the field study to verify the effects of the pre-overlay repair, as follows:

1. Verify and expand/modify the pavement performance criteria developed in the previous Task.
2. Use statistical analysis results to evaluate the performance based on the detailed field investigation.
3. Use the results of pavement performance to make comparisons and reach conclusions on the best performing types of treatment and use them to assist the guideline development.

Field measurements during overlay construction will provide the research team with consistent high quality data and information that contain the details before and after the overlay construction. These high quality data are necessary for verification of pavement performance based on pre-overlay preparation methods resulted from statistical analyses of historical project data.

It should be noted that field measurements are crucial to evaluating the overlay performance as they provide high quality information/data that are necessary to augment the information/data collected from previously rehabilitated projects. For example, the FWD measurements before and after overlay construction provide new variables that are not available in historical project data. Information about the structural capacity of pavement, the pavement layers moduli, resilient modulus of subgrade soil/quality of support, load transfer efficiency, etc. These variables will provide new input parameters that can be used in context of the proposed statistical analyses to quantify and differentiate the performance of pavements subjected to variety of pre-overlay repairs.

Task 4: Prepare a Guideline for Pre-overlay Repair

Based on the results and findings from the study, a guideline for pre-overlay repair will be prepared. This guideline will consist of performance-based practices to achieve consistently good overlay performance. This guideline is intended to be incorporated in the FDM and CMM.

2. WORK TIME SCHEDULE

The following table shows the timing of the different tasks selected for the project.

Table: Time Table for Completing Various Activities of the Study

Tasks	2009		2010				2011	
	Phase II							
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
<u>Task 1:</u> FWD Tests								
<u>Task 2(a):</u> Determine Overlay Lives								
<u>Task 3:</u> Validation of Previous Findings								
<u>Task 4:</u> Prepare a Guideline for Pre-overlay Repair								

3. REPORT

The interim findings from this study will be included in quarterly report. The final report will include literature review results and data collection results from Phase I; and the estimated lives of overlay with different repair methods, the life cycle cost analysis results of different repair methods, the validation of findings based on statistical analysis, and a guideline for pre-overlay repair. A draft final report will be submitted for the committee to review and comments. The team will also present the findings in a committee meeting after Phase I and Phase II. The comments from the committee will be addressed in the final report.